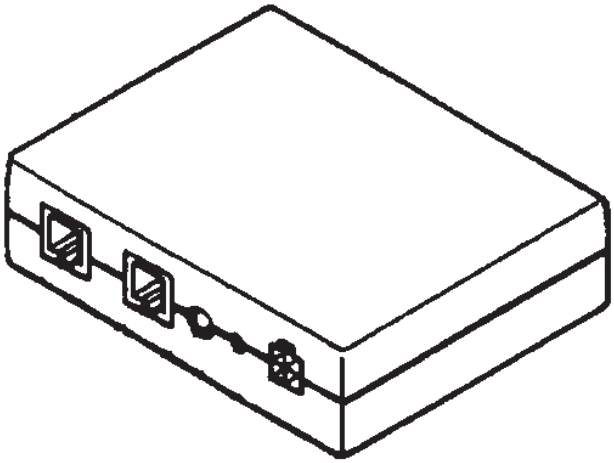
After Sales Technical Documentation

HF JUNCTION BOX
HFJ–2



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AMENDMENT RECORD SHEET

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HF JUNCTION BOX HFJ–2

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Introduction

General

The HFJ–2 Handsfree Junction Box provides and controls the supply voltages for the accessories rge current for the phone. In addition, it controls the audio paths to the accessories and handsfree equipment.

The unit contains a protection circuit against battery voltage transients, power switch, handsfree speaker and microphone amplifiers, audio switches, external I/O, switch mode charger and a microprocessor which communicates with the phone via the mbus interface.

The BABT approved version of HFJ–2 is known as HFJ–2X. Since both units are technically identical, all references to HFJ–2 equally apply to HFJ–2X.

Main Features

Accessories Supply Voltage

Filtered and switched voltages are supplied to peripheral devices and to handsfree audio parts in the HFJ–2 box. Protection against disturbances, such as overvoltages, transients in incoming battery voltage, is provided.

Audio Switches

Controls audio paths between phone, handsfree equipment and accessories.

Handsfree Audio Amplifiers

External microphone and speaker amplifiers for handsfree operation.

Charger

Provides supply voltage and charge current for phone.

External I/O

Open collector output, capable of driving an external relay.

Booster Interface

When requested via mbus message, HFJ–2 can read booster tuning values from booster EEPROM and send them to the phone. Tuning values can also be written to booster EEPROM.

Modes of Operation

Power–off Mode

The battery voltage is always connected to the accessory and charger power switches. The rest of the circuitry does not receive supply voltages.

Power–down Mode

+5 V supply voltages are switched on. The processor is in power down mode and its clock oscillator is not running.

Power–on Mode

The processor is executing code. +5 V supply voltages are on and other supply voltages are under processor control.

External Signals and Connections

The module is provided with five external connectors: power supply connector, external microphone connector, external speaker connector, phone connector, and accessory connector.

Power Supply Connector X210

Pin	Name	Description
1	XCRM	External car radio mute: open collector output is pulled down-when radio is muted, when radio is not muted, collector output is in a high impedance state. The load relay should be connected between this pin (1) and +Vbat. – on state max. voltage: +1 V – on state max. current: 250 mA – off state max. current: 1 mA – load resistance min.: 64 Ω
2	IGNS	Input controlling auto power off function: should be connected to car ignition switch (after switch) when in use and to ground when not in use.
3	GND	Power supply ground: should be connected to car battery negative terminal.
4	+VBAT	Power supply voltage: should be connected to car battery positive terminal.

External Microphone X230

Pin	Name	Description
1	GND	Ground for external microphone.
2	HFMIC	Supply voltage for microphone / audio signal from microphone.

External Speaker X250

Pin	Name	Description
1	GND	Ground for external speaker.
2	HFSP	Audio signal (d.c.) to speaker/speaker indication.

Accessory Connector X170

Pin	Name	Description
1	+VBS	Power supply for accessories; HFJ–2 turns this voltage on and off under phone control.
2	DGND	Digital Ground.
3	M2BUS	Serial mbus data between handset, HFJ–2 and accessories.
4	LSP	Not Connected.
5	PWR	This signal is pulled to +5 V at HFJ–2 via an internal resistor. Indicates external handset power–on switch state to HFJ–2.
6	AGND	Analog Ground.
7	MIC	Audio signal from accessories to phone (transmitted audio) or HF speaker (voice dialer phrase, answer machine message).
8	EAR	Audio signal from phone (received audio) or from HF micro-phone to accessories.

Phone Connector X290

Pin	Name	Description
1	SCL/TXI	IIC bus clock for booster; this signal is pulled to +5 V at HFJ–2 via the internal resistor of the processor. This pin is also used for booster error indication; in error condition, the booster pulls this pin (1) down (pin 1 can be used as an output to the boost-er at the same time). Periodically, Pin 1 is changed to input for 60 µs time and TXI state is polled. These polling pulses must be filtered in the booster.
2	PGND	Ground for charger.
3	M2BUS	Serial mbus data between phone, HFJ–2 and accessories.
4	VC	Supply voltage/charging current for phone.
5	HOOD/SDA	Handset hook ind./IIC bus data for booster.
6	SGND	Signal ground.
7	XMIC/ JCONN	Audio signal from accessories or HF microphone to phone: 100 kΩ pull–up to +5 V; d.c. level indicates connection of HFJ–2 box to phone.
8	XEAR/ HFJPWR	Audio signal from phone (received audio) to accessories or HF speaker: 1 MΩ pull–up resistor to +VBAT, drop down of current from this pin turns on +5 V supply to the processor.

Functional Description

Circuit Description

The BC4 module can be divided into seven blocks as follows:

– control
– charger
– audio switches
– external I/O
– power supply
– microphone amplifier
– speaker amplifier

Control Block

The main parts of the control block are the microcontroller D130 (83C51FA), mbus, and interrupt logic. D130 controls the audio paths, the charger, external I/O, the booster interface and the accessory power switch.

Interrupts are obtained from three sources: car ignition switch, handset's power switch, and mbus. Their purpose is to wake up the controller from power down mode. Mbus is the interface between the phone and other accessories except the booster. There are bidirectional buffer in mbus line, which regenerates the mbus signal.

Booster Interface

Tuning values from booster EEPROM are read immediately after power on (phone is connected to holder or wake up from power down). It is possible to read EEPROM values via mbus request, but it should not be done during conversation.

If booster EEPROM data and checksum are correct, tuning values are send to the phone and SCL/TXI line polling begins. If low level is detected phone is informed via mbus message. SCL/TXI line can be used as output at the same time and controlled by mbus messages. If no message is sent, the output state goes ”high”. Periodically SCL/TXI is changed to input and its state is read. This polling causes pulses, whitch must be filtered in booster.

Signals passed between the control block and the other blocks are shown in the following table:

Name	Description
PWR_ON	Accessory power switch on/off.
CH_ON	Charger on/off.
SCL/TXI	IIC bus clock for booster/booster error indication.
IO_EN	Voltage for several pull–up resistors (see circuit diagram). In power down mode, this signal is low level, to reduce current consumption.
XPWR	Handset's power on switch state.
IGNS	Car ignition switch state.
RXD	Mbus receive data.
TXD	Mbus transmit data.
CRM	Car radio mute
HP_MIC	Audio switch control between phone's xmic and accessories mic
HP_HFM	Audio switch control between phone's xmic and handsfree micro-phone
HF_EAR	Audio switch control between accessories ear and handsfree speaker
HF_MIC	Audio switch control between accessories mic and handsfree micro-phone
HP_EAR	Audio switch control between phone's xear and accessories ear
HP_HFS	Audio switch control between phone's xear and handsfree speaker
SIDE_T	Sidetone from X170 MIC to EAR control.
CHV	Charger voltage control, 12 or 15 V.
LO_V	Low voltage indication – generates reset for processor.

Charger

The charger is a switching mode voltage/current source. The switching frequency is fixed at approx. 80 kHz, generated by a separate RC oscillator. The charger has voltage and current feedback. At a light load (less than 800 mA current), the charger acts as a 12 V (or 15 V) voltage regulator; with a heavier load, it acts as a 800 mA current regulator. Input voltage can be higher or lower than the output voltage.

Signals passed between the charger block and the other blocks are shown in the following table:

Name	Description
+VPB	Supply voltage for power section
+VCH	Supply voltage for oscillator and comparators
CH_ON	On/off control
LO_V	Low voltage turn off
IO_EN	Reference voltage +5 V
+VC	Output voltage/current
PGND	Ground for output (”power ground”)

Audio Switches

Audio paths are controlled by seven CMOS analog switches N320 and N310. Paths for microphone and ear/speaker signals between phone and accessories, phone and handsfree, handsfree and accessories are possible. XEAR and XMIC lines from the phone includes a differential buffer amplifier N230. Both audio paths have d.c. decoupling capacitors, internal d.c. levels are 2.4 V.

Signals passed between the audio switch block and the other blocks are shown in the following table:

Name	Description
HP_HFS	See description of control block
HP_EAR	See description of control block
HF_MIC	See description of control block
HF_EAR	See description of control block
HP_HFM	See description of control block
HP_MIC	See description of control block
+2.4V	Internal d.c. levels
+5V	External d.c. levels
SIDE_T	Sidetone on/off
XEAR/ HFPWR	Received audio signal from handset
XMIC/ JCONN	Transmitted audio signal to handset
MIC	Audio signal to/from accessories
EAR	Audio signal to/from accessories

External I/O

The external I/O block consists of the car ignition key sense function and car radio mute function. When pin 2 at connector X210 is connected to the battery supply voltage, an interrupt pulse for the processor is generated. If the processor is in power down mode it powers up. The processor can also read the ignition key state. In the power on mode, this state is continuously polled, and an mbus message is sent to the phone, when this state changes.

Car radio mute is an open collector output capable of driving a relay. The purpose of the mute function is to mute the car radio during conversation. This output has a short circuit protection, which is triggered when pin 1 at X210 is directly connected to car battery voltage, while the output is turned on. When triggered, the output switches off and remains off, until it has been turned off and on again.

Signals passed between the ext. i/o block and the other blocks are shown in the following table:

Name	Description
IGNS	Car ignition key status to processor and interrupt pulse generator.
CRM	CRM on/off control from processor.
X210.2	IGNS input in connector X210.
X210.1	CRM output in connector X210.

Power Supply

The power supply provides a +5 V supply voltage for the processor and a +VCH voltage for the charger. When the xear/hfpwr line is connected to ground, via the 100 kΩ resistor, +5V voltage turns on. When +5 V is turned on, the processor can control +VCH.

When the supply voltage from the car battery is too low or regulator N270 can’t provide a stable +5 V, an error signal is generated by the power supply. This error signal is used to disable the charger and acts as a reset signal for the processor.

Signals passed between the power supply block and the other blocks are shown in the following table:

Name	Description
+VBP	Protected car battery voltage, supply voltage for this block.
+VCH	Charger supply voltage.
HFPWR	Power on/off control.
+5V	+5V supply voltage, output of this block.
LO_V	Low voltage error indication.

Microphone Amplifier

The handsfree microphone signal is amplified in N230, and directed to the handportable XMIC line or the accessories MIC line in the audio switch block. The accessory supply voltage (+VBS) is the supply voltage for the Microphone Amplifier also and hence must be available.

Signals passed between the mic. amp. block and other blocks are as shown in the following table:

Name	Description
HF_MIC	Amplified handsfree microphone output signal to audio switch block.
+12V	Supply voltage.
+2.4V	Internal d.c. level reference.
X290.2	Handsfree microphone input.
GAIN	Gain selection input, low level at this input gives higher gain.

Speaker Amplifier

This is a 4 W power amplifier for the handsfree loudspeaker. Audio signals from phone XEAR or accessories EAR lines are directed via the audio switch block to speaker amplifier N250. The gain is constant. The accessory supply voltage (+VBS) is the supply voltage for the Speaker Amplifier also and hence must be available.

Signals passed between the speaker amplifier block and other blocks are as shown in the following table:

Name	Description
+12V	Supply voltage.
+2.4V	Internal d.c. level reference.
HF_SP	Handsfree speaker input.
X250.2	Handsfree speaker output.

Figure 1: Block Diagram Version 5.0 3A 0694006

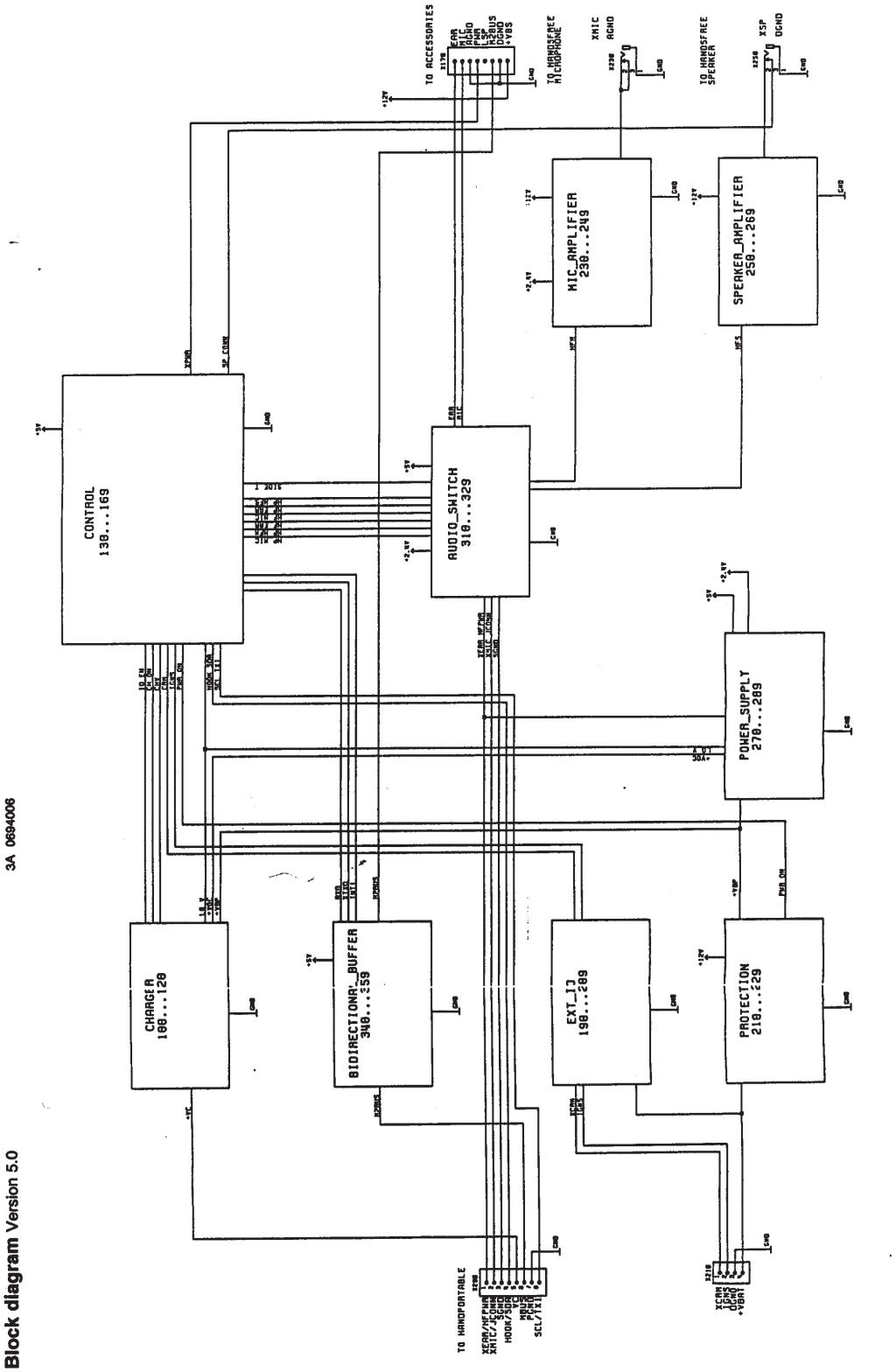
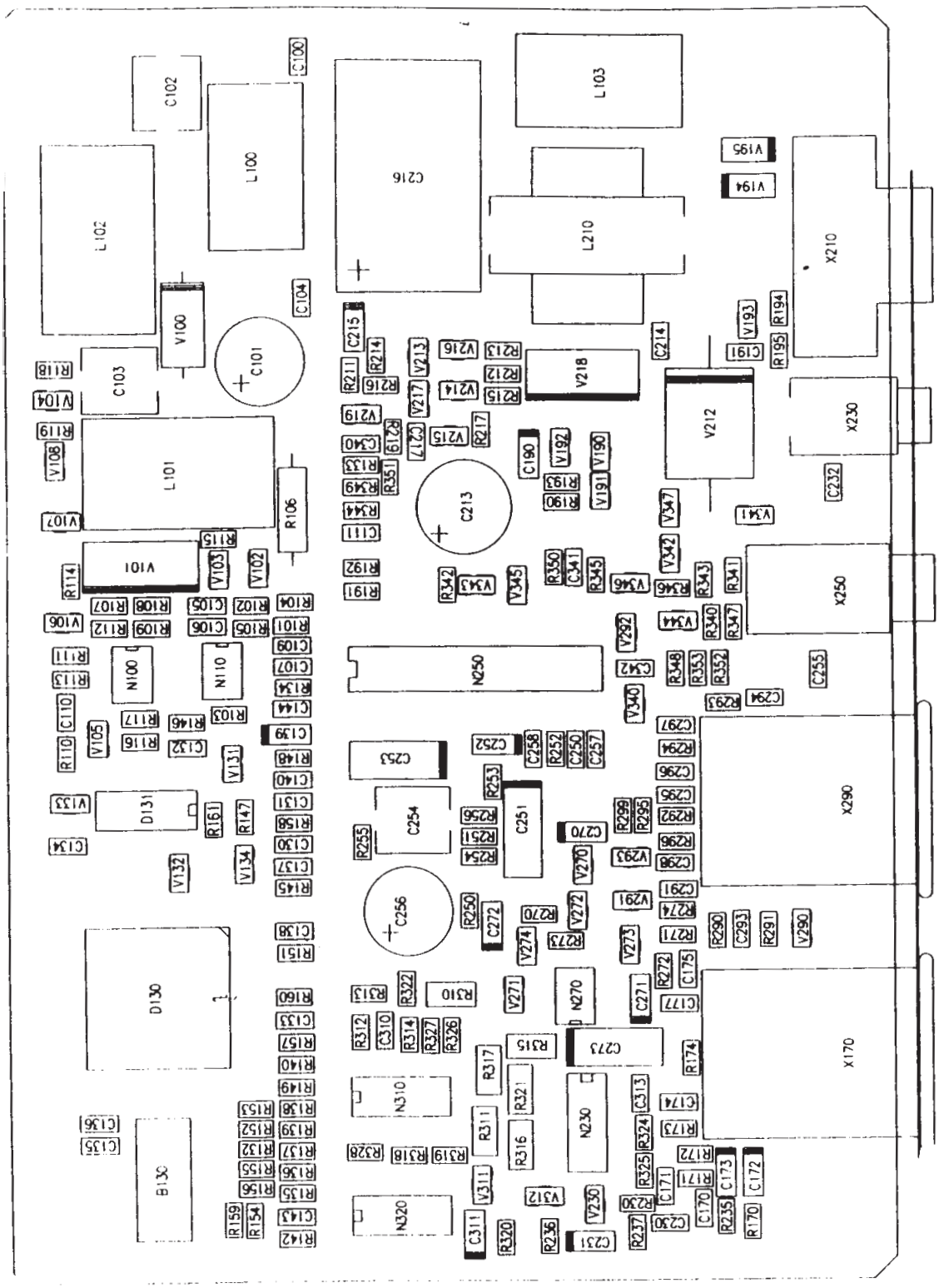


Figure 2: Component Layout Diagram



Parts List

ITEM	CODE	DESCRIPTION	VALUE	TYPE
R101	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R102	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R103	1414212	Chip resistor	330 k	5 % 0.063 W 0805
R104	1412511	Chip resistor	18 k	5 % 0.063 W 0805
R105	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R106	1400844	Melf resistor	0.33	2 % 0.7 W 6.5x2.5
R107	1414406	Chip resistor	5.6 k	5 % 0.063 W 0805
R108	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R109	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R110	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R111	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R112	1414406	Chip resistor	5.6 k	5 % 0.063 W 0805
R113	1414406	Chip resistor	5.6 k	5 % 0.063 W 0805
R114	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R115	1411669	Chip resistor	22	5 % 0.063 W 0805
R116	1412536	Chip resistor	22 k	5 % 0.063 W 0805
R117	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R118	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R119	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R132	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R133	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R134	1413804	Chip resistor	1.0 M	5 % 0.063 W 0805
R135	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R136	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R137	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R138	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R139	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R140	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R142	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R145	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R146	1413804	Chip resistor	1.0 M	5 % 0.063 W 0805
R147	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R148	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R149	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R151	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R152	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R153	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R154	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R155	1413635	Chip resistor	100 k	5 % 0.063 W 0805

R156	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R157	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R158	1413804	Chip resistor	1.0 M	5 % 0.063 W 0805
R159	1412729	Chip resistor	33 k	5 % 0.063 W 0805
R160	1413829	Chip resistor	10	5 % 0.063 W 0805
R170	1412261	Chip resistor	100	5 % 0.063 W 0805
R171	1412261	Chip resistor	100	5 % 0.063 W 0805
R172	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R173	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R174	1412303	Chip resistor	330	5 % 0.063 W 0805
R190	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R191	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R192	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R193	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R194	1413804	Chip resistor	1.0 M	5 % 0.063 W 0805
R195	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R211	1413716	Chip resistor	220 k	5 % 0.063 W 0805
R212	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R213	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R214	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R215	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R216	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R217	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R219	1412729	Chip resistor	33 k	5 % 0.063 W 0805
R230	1414212	Chip resistor	330 k	5 % 0.063 W 0805
R235	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R236	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R237	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R250	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R251	1413829	Chip resistor	10	5 % 0.063 W 0805
R252	1412729	Chip resistor	33 k	5 % 0.063 W 0805
R253	1412536	Chip resistor	22 k	5 % 0.063 W 0805
R254	1413829	Chip resistor	10	5 % 0.063 W 0805
R255	1412536	Chip resistor	22 k	5 % 0.063 W 0805
R256	1412303	Chip resistor	330	5 % 0.063 W 0805
R270	1414212	Chip resistor	330 k	5 % 0.063 W 0805
R271	1413804	Chip resistor	1.0 M	5 % 0.063 W 0805
R272	1414406	Chip resistor	5.6 k	5 % 0.063 W 0805
R273	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R290	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R291	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R292	1412303	Chip resistor	330	5 % 0.063 W 0805

R293	1412303	Chip resistor	330	5 % 0.063 W 0805
R294	1412303	Chip resistor	330	5 % 0.063 W 0805
R295	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R296	1412261	Chip resistor	100	5 % 0.063 W 0805
R299	1413716	Chip resistor	220 k	5 % 0.063 W 0805
R310	1416160	Melf resistor	100 k	1 % 0.2 W 0204
R311	1416160	Melf resistor	100 k	1 % 0.2 W 0204
R312	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R313	1412409	Chip resistor	1.5 k	5 % 0.063 W 0805
R314	1414212	Chip resistor	330 k	5 % 0.063 W 0805
R315	1416160	Melf resistor	100 k	1 % 0.2 W 0204
R316	1416160	Melf resistor	100 k	1 % 0.2 W 0204
R317	1416160	Melf resistor	100 k	1 % 0.2 W 0204
R318	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R319	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R320	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R321	1416160	Melf resistor	100 k	1 % 0.2 W 0204
R322	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R324	1413642	Chip resistor	56 k	5 % 0.063 W 0805
R325	1413642	Chip resistor	56 k	5 % 0.063 W 0805
R326	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R327	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R328	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R340	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R341	1414406	Chip resistor	5.6 k	5 % 0.063 W 0805
R342	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R343	1412729	Chip resistor	33 k	5 % 0.063 W 0805
R344	1412536	Chip resistor	22 k	5 % 0.063 W 0805
R345	1414406	Chip resistor	5.6 k	5 % 0.063 W 0805
R346	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R347	1413716	Chip resistor	220 k	5 % 0.063 W 0805
R348	1413723	Chip resistor	470 k	5 % 0.063 W 0805
R349	1412536	Chip resistor	22 k	5 % 0.063 W 0805
R350	1412729	Chip resistor	33 k	5 % 0.063 W 0805
R351	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R352	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R353	1414406	Chip resistor	5.6 k	5 % 0.063 W 0805
C100	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C101	2505261	Electrol. cap.	220	20 % 25 V 8.5x11.5
C102	2404094	Polyester cap.	470 n	10 % 63 V RM5
C103	2404094	Polyester cap.	470 n	10 % 63 V RM5
C104	2310791	Ceramic cap.	33 n	20 % 50 V 0805

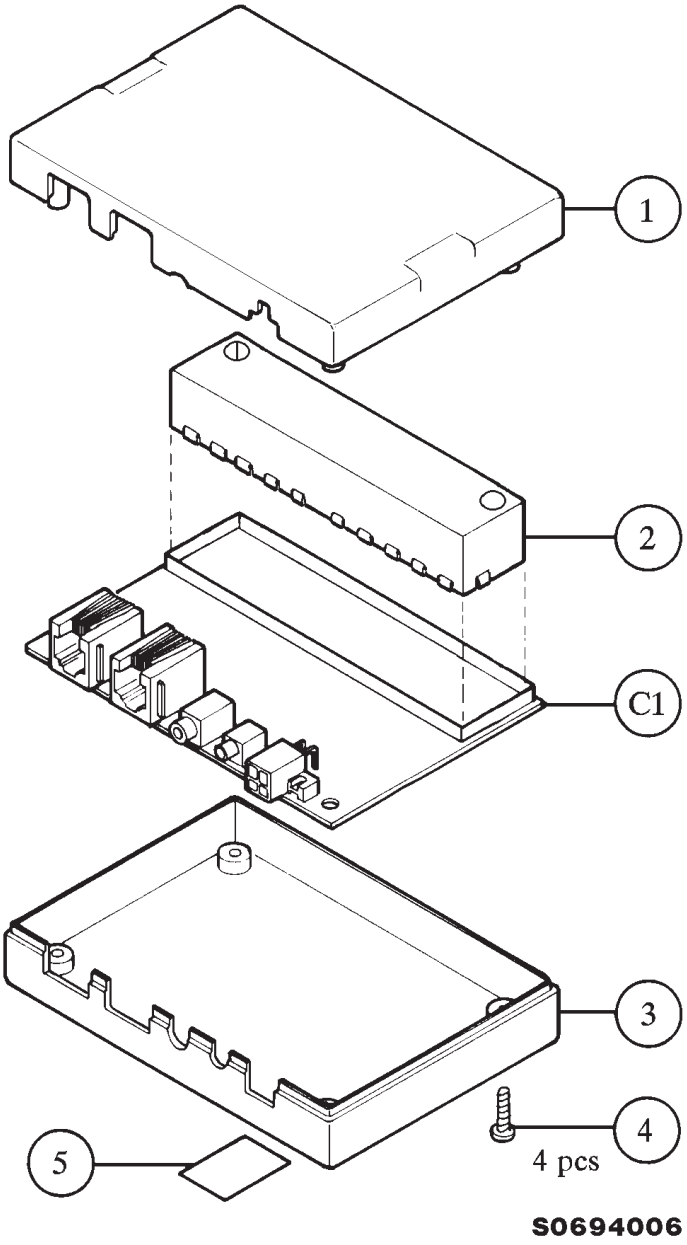
C105	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C106	2310738	Ceramic cap.	4.7 n	20 % 50 V 0805
C107	2310488	Ceramic cap.	330 p	5 % 50 V 0805
C109	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C110	2310488	Ceramic cap.	330 p	5 % 50 V 0805
C111	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C130	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C131	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C132	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C133	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C134	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C135	2310343	Ceramic cap.	22 p	5 % 50 V 0805
C136	2310343	Ceramic cap.	22 p	5 % 50 V 0805
C137	2310488	Ceramic cap.	330 p	5 % 50 V 0805
C138	2310488	Ceramic cap.	330 p	5 % 50 V 0805
C139	2604209	Tantalum cap.	1.0	20 % 16 V 3.2x1.6x1.8
C140	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C143	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C144	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C170	2310738	Ceramic cap.	4.7 n	20 % 50 V 0805
C171	2310738	Ceramic cap.	4.7 n	20 % 50 V 0805
C172	2604209	Tantalum cap.	1.0	20 % 16 V 3.2x1.6x1.8
C173	2604209	Tantalum cap.	1.0	20 % 16 V 3.2x1.6x1.8
C174	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C175	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C177	2310488	Ceramic cap.	330 p	5 % 50 V 0805
C190	2604209	Tantalum cap.	1.0	20 % 16 V 3.2x1.6x1.8
C191	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C213	2501605	Electrol. cap.	100	20 % 35 V RM3.5
C214	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C215	2604209	Tantalum cap.	1.0	20 % 16 V 3.2x1.6x1.8
C216	2507479	Electrol. cap.	1000	20 % 25 V 13x20mm
C217	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C230	2310463	Ceramic cap.	220 p	5 % 50 V 0805
C231	2604022	Tantalum cap.	0.1	20 % 35 V 3.2x1.6x1.8
C232	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C250	2310791	Ceramic cap.	33 n	20 % 50 V 0805
C251	2604431	Tantalum cap.	10	20 % 16 V 6.0x3.2x2.8
C252	2604209	Tantalum cap.	1.0	20 % 16 V 3.2x1.6x1.8
C253	2604431	Tantalum cap.	10	20 % 16 V 6.0x3.2x2.8
C254	2404094	Polyester cap.	470 n	10 % 63 V RM5
C256	2505261	Electrol. cap.	220	20 % 25 V 8.5x11.5

C257	2310752	Ceramic cap.		10 n	20 % 50 V 0805
C258	2310791	Ceramic cap.		33 n	20 % 50 V 0805
C270	2604209	Tantalum cap.		1.0	20 % 16 V 3.2x1.6x1.8
C271	2604209	Tantalum cap.		1.0	20 % 16 V 3.2x1.6x1.8
C272	2604209	Tantalum cap.		1.0	20 % 16 V 3.2x1.6x1.8
C273	2604431	Tantalum cap.		10	20 % 16 V 6.0x3.2x2.8
C291	2310791	Ceramic cap.		33 n	20 % 50 V 0805
C293	2310791	Ceramic cap.		33 n	20 % 50 V 0805
C294	2310488	Ceramic cap.		330 p	5 % 50 V 0805
C295	2310488	Ceramic cap.		330 p	5 % 50 V 0805
C296	2310791	Ceramic cap.		33 n	20 % 50 V 0805
C297	2310488	Ceramic cap.		330 p	5 % 50 V 0805
C298	2310488	Ceramic cap.		330 p	5 % 50 V 0805
C310	2310791	Ceramic cap.		33 n	20 % 50 V 0805
C311	2604209	Tantalum cap.		1.0	20 % 16 V 3.2x1.6x1.8
C313	2310738	Ceramic cap.		4.7 n	20 % 50 V 0805
C340	2310424	Ceramic cap.		100 p	5 % 50 V 0805
C341	2310424	Ceramic cap.		100 p	5 % 50 V 0805
C342	2310791	Ceramic cap.		33 n	20 % 50 V 0805
L100	3606698	Choke		60 µ	20 % 1 A FJ1445
L101	3607555	Coil	125	2 A	
L102	3607555	Coil	125	2 A	
L103	3606698	Choke		60 µ	20 % 1 A FJ1445
L210	3607898	Choke		2 A 900UH/1 kHz DH–TS582	
B130	4501008	Crystal		7.3728 M	16PF, 50PPM
V100	4100221	Schottky diode		21DQ06	60 V 1.7 A d3.7x7mm
V101	4200868	MosFet		IRF530	n–ch 10 V 14 A TO220
V102	4200917	Transistor		BC848B/BCW32	npn 30 V 100 mA SOT23
V103	4200909	Transistor		BC858B/BCW30	pnp 30 V 100 mA SOT23
V104	4107160	Zener diode		BZX84	5 % 12 V 0.3 W SOT23
V105	4108639	Diode x 2		BAS28	75 V 250 mA SOT143
V106	4200909	Transistor		BC858B/BCW30	pnp 30 V 100 mA SOT23
V107	4200917	Transistor		BC848B/BCW32	npn 30 V 100 mA SOT23
V108	4200917	Transistor		BC848B/BCW32	npn 30 V 100 mA SOT23
V131	4108639	Diode x 2		BAS28	75 V 250 mA SOT143
V132	4106769	Zener diode		BZX84	5 % 4.7 V 0.3 W SOT23
V133	4200917	Transistor		BC848B/BCW32	npn 30 V 100 mA SOT23
V134	4106769	Zener diode		BZX84	5 % 4.7 V 0.3 W SOT23
V190	4200836	Transistor		BCX19	npn 50 V 0.5 A SOT23
V191	4108639	Diode x 2		BAS28	75 V 250 mA SOT143
V192	4200917	Transistor		BC848B/BCW32	npn 30 V 100 mA SOT23
V193	4200917	Transistor		BC848B/BCW32	npn 30 V 100 mA SOT23

V194	4101653	Diode	BYD17D	200 V 1.5 A SOD87
V195	4101653	Diode	BYD17D	200 V 1.5 A SOD87
V212	4100218	Trans. supr.	LDP24A	100 V 30A/40 ms AG
V213	4200603	Transistor	BCX17	pnp 45 V 500 mA SOT23
V214	4200603	Transistor	BCX17	pnp 45 V 500 mA SOT23
V215	4110195	Zener diode	BZX84	5 % 18 V 0.3 W SOT23
V216	4200603	Transistor	BCX17	pnp 45 V 500 mA SOT23
V217	4108639	Diode x 2	BAS28	75 V 250 mA SOT143
V218	4209990	MosFet	IRF9530	p–ch 10 V 12 A TO220
V219	4200836	Transistor	BCX19	npn 50 V 0.5 A SOT23
V230	4110117	Zener diode	BZX84	5 % 3.9 V 0.3 W SOT23
V270	4200836	Transistor	BCX19	npn 50 V 0.5 A SOT23
V271	4108639	Diode x 2	BAS28	75 V 250 mA SOT143
V272	4110195	Zener diode	BZX84	5 % 18 V 0.3 W SOT23
V273	4116536	Zener diode	BZX84	5 % 2.4 V 0.3 W SOT23
V274	4200603	Transistor	BCX17	pnp 45 V 500 mA SOT23
V290	4106769	Zener diode	BZX84	5 % 4.7 V 0.3 W SOT23
V291	4106769	Zener diode	BZX84	5 % 4.7 V 0.3 W SOT23
V292	4107160	Zener diode	BZX84	5 % 12 V 0.3 W SOT23
V293	4106769	Zener diode	BZX84	5 % 4.7 V 0.3 W SOT23
V311	4106769	Zener diode	BZX84	5 % 4.7 V 0.3 W SOT23
V312	4106769	Zener diode	BZX84	5 % 4.7 V 0.3 W SOT23
V340	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V341	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V342	4200909	Transistor	BC858B/BCW30	pnp 30 V 100 mA SOT23
V343	4108639	Diode x 2	BAS28	75 V 250 mA SOT143
V344	4200909	Transistor	BC858B/BCW30	pnp 30 V 100 mA SOT23
V345	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V346	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V347	4107160	Zener diode	BZX84	5 % 12 V 0.3 W SOT23
D130	4375034	IC, MCU	PLCC44	
D131	4309914	IC, 6 x sch.inv	74HC14	SO14
N100	4305236	IC, 2 x comp.	LM2903	SO8S
N110	4301199	IC, 2 x op.amp.	LM2904	SO8S
N230	4301182	IC, 2 x op.amp.	LM2902	SO14S
N250	4303439	IC, af amp4w/14v 4–20v dil1	TDA1904	DIL16S
N270	4301062	IC, regulator	LP2951AC	SO8S
N310	4309488	IC, 4 x bi.switch	74HC4066	SO14S
N320	4309488	IC, 4 x bi.switch	74HC4066	SO14S
X170	5416517	Modular jack 8 pin pcb		
X210	5439668	Connector 2x2 pole right angle	PCB	
X230	5407002	Jack 2,5mm horizontal female pcb		

X250	5407006	Jack 3,5mm horizontal female pcb		
X290	5416517	Modular jack 8 pin pcb		
	4340082	IC, MCU	PLCC44	
	9380149	Sticker brady lat–2–747 9.5x9.5		
	3200047	Ferrite ring d 3.5x1.3x4.3mm f2		
	7510302	Adhesive stick jet–melt tc–3748		
	9510077	Emc–chassis1	3D21557	THX–7X,THN–thx–7x,thn–7
	9730043	Ns–strip 0.4x128 cuni12zn24–04		
	9853848	PC board	BC4A	114.9x79.5x1.6 d 2/pa
	0240120	IC, SWRAM	SW HFJ–2/3	

Figure 3: Exploded View



Assembly Parts

ITEM	Q'TY	CODE	DESCRIPTION	VALUE, TYPE
1		9450050	Cover	1D 21289
1		9450067	Cover	1D 21307
2		9510078	EMC cover	3D 21558
3		9450066	Bottom cover	1D 21305
4	4	6292014	PT screw KB25x16	WN1442 FeZn
5		9370113	Type label	4D 21617
C1		0200045	BC4 charging module	